
Impact of Increased Physician Supply on Use of Health Services: a Longitudinal Analysis in Rural Minnesota

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Synopsis

Prevalence studies of the use of ambulatory health care services have consistently reported relatively lower demand for services in rural areas. Such studies have implied that low use rates may be fixed characteristics of rural populations and may be resistant to the influence of manipulable variables such as supply of physicians. This longitudinal study suggests that use rates are in fact significantly changed after improvement of manpower resources, but that the effects are limited to the vicinity of new practice locations.

IN RECENT YEARS, numerous public and private sector programs have sought to locate more physicians in rural areas. These efforts, often based on observations of shortages of physicians, assume that increased medical manpower in such regions will redress the perpetual problems of unmet medical needs.

An uncritical acceptance of these customary notions of the relation between manpower supply and use of medical services ignores the complex determinants of ambulatory care demand. In contrast to hospital use in rural areas—which is sensitive to the availability of beds and often matches urban patterns (1)—rural consumption of outpatient services is relatively low (2–4). In an earlier publication (5), we proposed that the relative inelasticity of ambulatory care demand vis-a-vis physician supply may be a fixed characteristic of rural populations. We do not know whether the addition of new physicians to a health service area with relatively constant sociodemographic variables alters low use rates for ambulatory care. The analysis reported here, covering a period of 5 years, examines the hypothesized insensitivity of rural use of outpatient services to physician supply.

The rural area examined in this study—the town of Zumbrota and 12 adjoining townships in southeastern Minnesota—is neither geographically remote nor economically disadvantaged in comparison with many other rural communities in the country. The area was chosen for study because of local demand that led to the establishment of a family

practice clinic. Assigning to the area a bureaucratic, admittedly arbitrary, label of “medically underserved” or “inadequately served,” either before or after the area’s increase in physician supply, was not pertinent to the study’s central goals.

The Zumbrota area is characterized by low population density, occupational diversity, preeminence of agricultural pursuits, and relative cultural homogeneity. It typifies many rural areas in the Corn Belt where distance from urban centers does not prevent ready access to referral services and where the presence of local medical resources, including a small hospital, is attractive to family physicians.

Given the great variability of rural regions in the nation, the results of the study we report here may not be readily generalizable to all rural populations. However, the generic issues of ambulatory care utilization uncovered by this study are sufficiently universal to warrant a description of the trends we found.

The Survey Area

The universe of our study consisted of all households in Zumbrota, located in Goodhue County, and 12 adjoining townships. Zumbrota is 25 miles northwest of Rochester and 50 miles southeast of Minneapolis, adjacent to a divided four-lane highway.

We conducted surveys of a sampling of these households in 1975 (5) and 1980. The survey universe contained 12,583 persons in 1970, 13,959 in

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1980 (U.S. Census data). In 1970, 42 percent of the survey area population lived within six small towns (45 percent in 1980). The towns of Zumbrota (population 1,929 in 1970; 2,129 in 1980) and Pine Island (population 1,640 in 1970; 1,977 in 1980) were by far the largest.

Although no new subdivisions were established in the area between surveys, the age-sex structure of the sample changed over time. Increases were seen in the number of males 15–44 years of age and the number of females 15–64 years; however, these changes were not statistically significant.

The economic profiles of Zumbrota and Pine Island are dominated by two large dairies, various light industrial facilities, the retail segments of the downtown area, the city services themselves, the Zumbrota hospital, and two nursing homes. The economics of the outlying areas are more difficult to assess; however, the countryside within the boundaries of the study area is almost exclusively devoted to farming.

The health care facilities in the area had been relatively constant before 1975. Zumbrota's hospital, staffed by local physicians, had (and still has) 24 beds, and the nursing homes in Zumbrota and Pine Island had (and have) a total of 145 beds. In 1974, there were three full-time general practitioners in established, solo private practices in the survey area (two in Zumbrota, one in another town 8 miles from Zumbrota). All three have continued to practice there.

In 1975, the Mayo Clinic opened the Zumbrota Health Facility, which was staffed by two full-time family practitioners. In 1979, one of these physicians left the facility to set up a solo practice in Zumbrota; he was replaced by another family practitioner during the same year. Thus, in 1979 there were the original three local physicians, supplemented by two physicians in the Zumbrota Health

Facility and one new solo practitioner—an increase of 100 percent over the number of full-time physicians in 1974. In addition, a part-time clinic, staffed by Mayo Clinic resident physicians, was open for a total of 12 hours per week in Pine Island during both survey periods and the intervening years.

To aid analysis, we subdivided the area into two parts, according to distance from the new Zumbrota Health Facility: (a) Zumbrota itself and four contiguous townships and (b) the remainder of the area, which includes the other, noncontiguous townships.

Methods

Our first sampling of Zumbrota area households was conducted in 1975 before establishment of the Zumbrota Health Facility. The two-stage sampling procedures, described earlier (5), were designed to be self-weighting. Thus, Zumbrota area rates could be directly computed from the sample.

In 1980, the Zumbrota area was resurveyed, using the same housing units or new houses constructed within the same area. The two survey populations therefore contained a large number of persons who lived in the same housing units in both 1975 and 1980. Although they were not representative of the Zumbrota area, these geographically stable persons gave us an opportunity to examine changes in use of medical services in more detail. In the 1975 survey, this group's use of health services was found to be less frequent than that of the national population (data derived from the 1969 National Health Survey). In the 1980 survey, this surviving cohort showed patterns of utilization not dissimilar to the national estimates for 1975 (6).

A similar questionnaire was used in both surveys to gather data on all members of the sampled households. The questionnaire was designed to obtain socioeconomic, demographic, health care utilization, and attitudinal data. The recall periods for both surveys were the prior calendar years: 1974 and 1979. Interviewers were trained to probe for possible lapses in respondents' memories and to cross-validate responses in the interviews. A proxy response was obtained from an adult for all respondents under 18 years of age and for those adults unable to communicate adequately.

Data for the total sample were used for comparison with national data and for assessment of overall changes in use of physicians' services. Data on the surviving cohort that may provide insights into motivations for health care utilization are presented in an unpublished paper.

In this analysis, "total physician contacts" are defined as office, home, emergency room, and tele-

phone contacts; "physician visits" are defined as total physician contacts minus the number of telephone contacts. Unlike our earlier publication (5), this analysis excludes nurse visits.

For the statistical comparisons with national data, both the Zumbrota area and the National Health Interview Survey (6) age- and sex-specific rates were standardized to the 1980 Minnesota population. National nonstandard metropolitan statistical area (non-SMSA) rates were calculated to resemble the Zumbrota farm-nonfarm distribution (60 percent farm, 40 percent nonfarm). (Since national data are based on a 2-week recall, exact comparisons with Zumbrota area data are somewhat difficult. However, this paper focuses on changes in the Zumbrota area between the 1975 and 1980 surveys, which—as noted earlier—used 1-year recall periods.)

Results

Our intent in both surveys was to sample approximately 10 percent of the Zumbrota area's population. Universe, sample size, and number of respondents for both survey years were as follows:

<i>Population, sample size, and respondents</i>	1975	1980
Total population	112,583	213,959
Zumbrota and contiguous townships	14,439	24,795
Noncontiguous area	18,146	29,164
Households targeted	461	471
Households contacted	427	456
Persons responding	¹ 1,339	1,343
Zumbrota and contiguous townships	408	424
Noncontiguous area	931	919

¹ 1970 U.S. Census.

² 1980 U.S. Census.

³ Seven subjects with partial interviews were included for purposes of this paper, but were excluded from reference 5.

The "surviving cohort," persons interviewed in both years, numbered 736, or 55 percent of the 1975 sample.

Demographic characteristics of the two cross-sectional samples were consistent, with only a small decrease in the proportions in each tail of the age distribution. Table 1 provides the distribution of each sample by age and sex. The mean age for each sample was 34 years. The proportion of males to females (52:48) was constant for both surveys. Both population samples were somewhat younger than the U.S. population, since the elderly represented only 6 percent of the Zumbrota area population. The extent of pregnancies, which could

'Our data suggest that (a) the availability of a regular source of medical care in rural populations is a strong determinant of demand, (b) an increase in the number of local physicians has a significant influence on the utilization behavior of a proximate population, and (c) low use rates are not an unalterable characteristic of a rural population.'

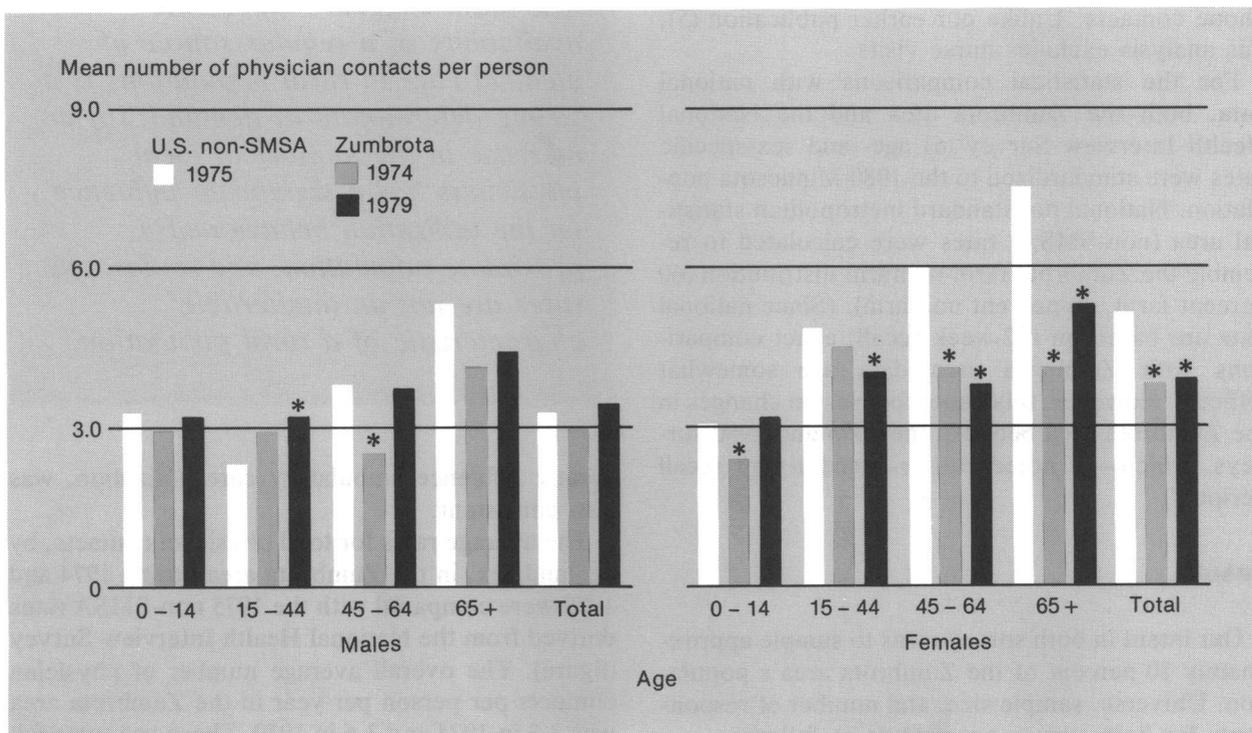
greatly influence ambulatory care utilization, was also consistent.

The average rates for total physician contacts, by age and sex, in the Zumbrota area during 1974 and 1979 were compared with the 1975 non-SMSA rates derived from the National Health Interview Survey (figure). The overall average number of physician contacts per person per year in the Zumbrota area was 3.3 in 1974 and 3.6 in 1979. These use rates fall below the 1975 national figures of 4.1 physician contacts per person per year for non-SMSA areas with similar farm and nonfarm mix. Neither the absolute increase in total physician contacts between 1974 and 1979 in the Zumbrota area nor the comparison after standardization to the 1980 Minnesota population was statistically significant.

The overall use rates for both ambulatory care and hospital services in 1974 and 1979, standardized to the 1980 Minnesota population, are provided in table 2. Small, though not statistically significant, increases were noted in the percentages of respondents who saw a physician and who were hospitalized in 1979, as well as in the rates for hospitalizations, office visits, and emergency room visits per person per year. Small decreases were seen in the rates for phone contacts and hospital days per person per year.

All respondents in both surveys were asked to identify the physician or clinic they considered to be their regular source of medical care. Table 3 presents the data on this question, with sources of care geographically grouped. A larger proportion of patients had most of their care provided in Zumbrota (where the physicians were added), but this increase appeared to be at the expense of more distant sources, rather than to come from the group of patients with no previous regular source of care (chi-square test, $\chi^2 = 24.4$, $df = 6$, $P < .001$). The

Physician contact rates for respondents to Zumbrota area surveys compared with rates for U.S. nonstandard metropolitan areas with similar farm-nonfarm mix



*Statistically significant difference between Zumbrota area survey and U.S. rates at $P < 0.05$.
 NOTE: Zumbrota area surveys were conducted in 1975 and 1980, using a 1-year recall period.
 SOURCE for U.S. non-SMSA: reference 6.

Table 1. Demographic comparisons between respondents to the Zumbrota area surveys in 1975 and 1980 (percentages)

Variables	1975 (N = 1,339)	1980 (N = 1,343)
Males	51.9	52.5
0-14 years	15.4	14.8
15-44 years	19.0	21.3
45-64 years	11.1	10.4
65 years or older	6.4	6.0
Females	48.1	47.5
0-14 years	13.1	11.2
15-44 years	18.0	19.1
45-64 years	9.8	10.7
65 years or older	7.2	6.5
Females pregnant in previous year	2.4	2.0
Mean age, all respondents	34.2	34.0

increase in patients with no regular source of care (7.4 percent in 1974 versus 10.8 percent in 1979) was significant; when we restricted our analysis to adults, however, this increase was not statistically significant (10.1 percent in 1974 versus 12.7 percent in 1979).

Two further aspects of ambulatory care use were investigated. The first question dealt with use

changes among adults, categorized by the distance they lived from where new physicians had located: Zumbrota proper and its contiguous townships versus the remaining area (noncontiguous townships). The second question dealt with the changes in ambulatory care use in the population subsample (the surviving cohort), categorized by consistency of a regular source of care between surveys.

Table 4 presents statistics on ambulatory care use in 1974 and 1979 by respondents 18 years of age or older, by geographic region. (Both tables 4 and 5 focus on persons 18 or older because use changes were concentrated in this group.) Although the number of respondents in each category remained fairly stable, the mean number of office visits per person per year rose significantly among those who lived in Zumbrota and contiguous townships ($P = .014$). Those living in the remaining area had no significant change in number of office visits. The total number of office visits generated by those living in Zumbrota and contiguous townships increased by 45.8 percent; thus, it appears that significant jumps in ambulatory care use occurred in geographic clusters of the population close to Zumbrota.

To address the association between changes in regular source of care and changes in utilization, all

Table 2. Use of medical care in 1974 and 1979 by respondents to the Zumbrota area surveys¹

Measure of use	1974		1979	
	Standardized rate ²	S.E.	Standardized rate ²	S.E.
Percentage of respondents seeing physician during year	71.1	1.3	74.2	1.2
Number of physician contacts per person per year	3.440	0.193	3.676	0.146
Telephone contacts	0.538	0.068	0.417	0.034
Number of physician visits per person per year	2.903	0.160	3.260	0.128
Office visits	2.654	0.146	2.966	0.119
Emergency room visits	0.231	0.028	0.269	0.024
House calls	0.024	0.014	0.025	0.014
Percentage of respondents hospitalized in year	9.6	0.8	11.0	0.9
Number of hospitalizations per person per year	0.113	0.011	0.128	0.011
Number of hospital days per person per year	0.891	0.131	0.852	0.119

¹ Surveys were conducted in 1975 and 1980, using a 1-year recall period.
² Raw data were standardized to the 1980 Minnesota age-sex structure.

NOTE: No difference between rates was statistically significant at $P < .05$ by t test.

the respondents in the surviving cohort were categorized into five groups:

- those who had the same regular source of care during both 1974 and 1979;
- those who had changed their regular source of care since 1974;
- those who had switched from no care in 1974 to a regular source of care in 1979;
- those who had switched from a regular source of care in 1974 to no care in 1979; and
- those who had no regular source of care in either year.

In addition, those who changed sources of care were subdivided into those who saw newly established physicians and those who saw previously established physicians.

Table 5 provides the number of respondents and use-of-care measures per person per year for each of the five groups, as well as paired t -test results for evaluation of the changes over the 5-year period. It is of interest that respondents who changed their regular source of care significantly increased their use of ambulatory care services, while patients who maintained the same source of care did not make statistically significant higher use of these services. The largest increases in physician visits were seen in those who went to previously established physicians (a 2.6 visit increase) rather than to new physicians (a 0.5 visit increase).

Discussion

Although several surveys (1,4,7) have reported lower per capita and aggregate use of physicians' services in rural areas, we are unaware of any lon-

Table 3. Regular sources of ambulatory medical care in 1974 and 1979, by geographic area, for respondents to the Zumbrota area surveys¹

Source	1974		1979	
	Number	Percent	Number	Percent
No regular source	99	7.4	145	10.8
Zumbrota ²	433	32.3	530	39.5
Within 10 miles of				
Zumbrota ²	183	13.7	150	11.2
Rest of Goodhue County ³	180	13.4	172	12.8
Olmstead County ³	269	20.1	265	19.7
Wabasha County ³	42	3.1	47	3.5
Other	133	9.9	34	2.5

¹ Surveys were conducted in 1975 and 1980, using a 1-year recall period.
² Within survey area.
³ Neighboring county outside survey area.

gitudinal studies that have examined the impact of expanded physician manpower on utilization behavior. The prevailing wisdom suggests that an expanded supply of physicians in rural areas that presumably removes barriers to access will be matched by an increased demand for the physicians' services. On the surface, our observations with respect to the Zumbrota area fail to reinforce this opinion.

The salient suggestion of the Zumbrota area data is that the overall rates for ambulatory care use by the *entire* population, over a large health service area, did not significantly change between two observational periods and were apparently not influenced by an increase of medical manpower in Zumbrota. In both the 1975 and the 1980 surveys, the overall rates reported for physician contacts, as well as the rates of such contacts for most age-sex groups, were below those reported for comparable non-SMSAs with similar farm and nonfarm mix in the National Health Interview Survey. However,

an analysis of subsamples of the Zumbrota area population refutes the simple notion that low use rates for ambulatory care services are an unalterable characteristic of rural residents. When the use rates of residents living in Zumbrota and contiguous

townships were critically examined, they were seen to be significantly higher in 1979 than in 1974. It is not possible to state categorically whether an increase of 45 percent in total office visits reflects demand generated by the presence of new physi-

Table 4. Changes in use of ambulatory medical care in 1974 and 1979 among respondents to the Zumbrota area surveys¹ 18 years of age or older, by location of residence

Measures of use	1974		1979		Difference	T-test P value
	Mean	S.D.	Mean	S.D.		
Respondents living in Zumbrota and adjacent townships²						
Office visits	2.35	3.33	3.19	4.85	0.84	.014
Physician visits (office, emergency room, house calls)	2.64	3.81	3.43	5.06	0.79	.031
Physician contacts (physician visits, telephone calls)	3.12	5.01	3.71	5.49	0.59	.176
Respondents living in other areas³						
Office visits	3.00	5.05	3.25	4.86	0.25	.378
Physician visits (office, emergency room, house calls)	3.23	5.68	3.57	5.22	0.34	.295
Physician contacts (physician visits, telephone calls)	3.80	7.52	4.01	6.01	0.21	.606

¹ Surveys were conducted in 1975 and 1980, using a 1-year recall period.

³ N = 572 in 1975 survey, 593 in 1980 survey.

² N = 284 in 1975 survey, 305 in 1980 survey.

Table 5. Changes in use of ambulatory medical care in 1974 and 1979 among the surviving cohort of the Zumbrota area surveys,¹ 18 years of age or older, by change in regular source of care status

Status	Number of respondents	Measures of use			Paired t-test significance
		1974	1979	Difference	
Mean office visits					
Same source	252	3.04	3.34	+0.30	.471
Different source	155	2.67	3.62	+0.95	.114
New physician	61	2.28	4.17	+1.89	<.001
Established physician	94	2.02	4.52	+2.50	<.001
No source → source	29	1.00	2.76	+1.76	.030
Source → no source	45	1.80	0.93	-0.87	.050
No source either year	13	0.62	0.08	-0.54	.111
Mean physician visits (office, emergency room, house calls)					
Same source	252	3.34	3.63	+0.29	.537
Different source	155	2.63	4.41	+1.77	<.001
New physician	61	3.28	3.80	+0.52	.471
Established physician	94	2.21	4.80	+2.59	<.001
No source → source	29	1.14	3.00	+1.86	.031
Source → no source	45	1.87	0.98	-0.89	.048
No source either year	13	0.62	0.23	-0.38	.316
Mean physician contacts (physician visits, telephone calls)					
Same source	252	4.02	4.03	+0.01	.989
Different source	155	2.96	4.86	+1.90	.002
New physician	61	3.57	3.98	+0.41	.585
Established physician	94	2.56	5.43	+2.86	<.001
No source → source	29	1.24	3.03	+1.79	.036
Source → no source	45	2.22	1.00	-1.22	.027
No source either year	13	0.62	0.31	-0.31	.436

¹ Surveys were conducted in 1975 and 1980, using a 1-year recall period.

cians or signals the magnitude of unmet medical needs in the community.

Past observations regarding lower rural use of ambulatory care services have been based on cross-sectional studies that fail to consider population behaviors in response to structural change. Even though our longitudinal data are a more accurate reflection of the use of health services, a less critical examination of the overall use trends at first glance tends to support the notion of fixed, unalterable utilization. Our data suggest that (a) the availability of a regular source of medical care in rural populations is a strong determinant of demand, (b) an increase in the number of local physicians has a significant influence on the utilization behavior of a proximate population, and (c) low use rates are not an unalterable characteristic of a rural population.

The most striking observation from this longitudinal study is the dispersal of the sources of regular care over a wide health service area. Despite doubling of the number of physicians in a centrally located small town, over a period of 5 years rural residents continued to purchase services from relatively distant sources. Travel distance is seemingly not a deterrent to rural residents, who may choose remote outposts over closer sources of regular care. Our observations in both the 1975 and 1980 surveys support this impression. In both surveys, a large percentage of the population claimed sources of regular care in neighboring counties beyond the survey area. What is particularly noteworthy, however, is the perseverance of the distributive characteristics over time. In 1975, a third of the sample population claimed local Zumbrota physicians as sources of regular medical care. Five years later, despite doubling of the local physician supply in the town of Zumbrota, the majority of patients continued to seek regular care at medical facilities beyond the limits of the survey area. Given evidence of "shopping" behavior among rural residents (2), it is conceivable that these patterns of utilization will continue to change, although the data would lead us to anticipate no substantial further focusing of health care demand on the closest medical resource.

The observed patterns of dispersal do not argue against the possibility of robust, self-sustaining local practices. Indeed, most evidence (8) suggests that new rural practices gradually attain fiscal equilibrium in time, and we have no reason to believe that the established practices in the Zumbrota area are in financial difficulty.

The data from this study suggest that when new medical practices are added to a community, local

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ambulatory care use rates are driven up because of increased use by patients who already have regular sources of medical care. These changes do not seem to relate to the new physicians only, since our observations suggest that larger use increases (2.6 more physician visits) occurred among patients who switched to previously established physicians than among those who switched to new ones (0.5 more physician visits). Successful practices drew patients from contiguous townships and developed client affiliations over a fairly large rural health service area. A drop in the number of patients seen by the established practitioners was balanced by increases in the average number of visits per patient.

In summary, even though organizational, fiscal, and sociodemographic factors are strong determinants of the growth of new practices in rural areas, impetus for such growth can also be provided by an accelerated demand for services by the resident population. Significant increases in use of ambulatory health care services are likely to occur in population subgroups proximate to new practice locations. However, new local practices may not influence the shopping behavior of all patients, many of whom seek regular care at distant medical sites. It is conceivable that the growth of new practices derives in part from client affiliations over an expanded rural health service area; however, to some degree, increased utilization also contributes to the viability of practices.

It should be emphasized that the longitudinal profile of one rural Minnesota population cannot be generalized to all similar rural regions. Our conclusions need to be validated by similar studies in other rural populations.

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A Survey Approach for Finding Cases of Epilepsy

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Synopsis

Identify persons with epilepsy by first looking for prescriptions for particular antiseizure drugs. Follow these prescriptions from the pharmacies to the physicians who wrote them for patients. Ask the physicians whether the patients have epilepsy. Finally, contact the patients who do have epilepsy to elicit information about the impact of that condition on their lives.

With these steps, it may be possible to carry out successfully a probability survey of epilepsy in the United States population. To learn more about this

approach, a field test was funded by the National Institute of Neurological and Communicative Disorders and Stroke (NINCDS) of the Public Health Service. From 1978 through 1982, the work was planned, carried out, and evaluated by Research Triangle Institute, Research Triangle Park, NC.

Epilepsy is a sensitive topic to ask about in a survey. Also, the condition is sufficiently rare to render ordinary survey approaches inefficient. Even if rarity were not an issue, there would be the problem of response error because a person with epilepsy does not, as a rule, have much clinical information on his or her condition. Better information lies with the physician who provides the care, but many physicians are busy with their practices. Furthermore, their record systems are usually not designed for easy retrieval of information, unless the names of patients are available. In the survey approach considered here, the names of patients are obtained through a random sampling of prescriptions for antiseizure drugs.

The field test was divided into three phases with special activities reserved for each. The most important problem confronted was how to safeguard the confidentiality of relationships between pharmacist and patient and between physician and patient. Special guidelines on confidentiality were put into effect for the data collection. These guidelines, however, contributed to serious problems of non-response—especially for physicians. This article provides a brief account of the field test, including a rationale for the survey strategy of finding cases of epilepsy through prescriptions for antiseizure drugs.

EPILEPSY REFERS TO A CATEGORY of chronic disorders characterized by sudden, recurrent attacks of brain dysfunction with abnormal electrical dis-

charges. These attacks, called seizures, are usually associated with some alteration of consciousness and may or may not involve convulsive movements.